Zennio
Passion for KNX innovation

IRSC Zone

Ducted Air-Conditioner Zoning IR Controller

(1-8 Zones)

ZN1CL-IRSC

Application program version: [1.8]
User manual edition: [1.8]_a

www.zennio.com

USER MANUAL

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DOCUMENT UPDATES

Version	Modifications	Page(s)
[1.8]_a	**Changes in the application program**: - Compatibility with additional remote controls. - Revision of texts.	-
	New structure in sections “Introduction” and “Configuration”.	4 - 8
	Update of the Communication Object Table.	29
	General revision of texts and styles.	-
[1.7]_a	**Changes in the application program**: - New parameter added (“Zone Update After Reset”) to allow sending read requests for the states, modes and zone setpoints after bus failures. - Revision of texts and parameter names. - Function added to let the device store the current mode on bus failures even if the machine was off. - Inversion of the order of certain read requests sent after reset, in order to avoid unexpected behaviours of the device (such as when both the *normal* mode and the *extended* mode read requests receive a response). - Implementation of the temperature restriction even when the machine is off, not only when it gets switched on. - Reset of the variables of the PI control algorithm when power failures occur.	-
[1.6]_a	**Changes in the application program**: Option added to send read requests of certain objects to the bus in order to recover the state of the device after a download or a device reset from ETS.	-

1 INTRODUCTION

1.1 THE IRSC CONTROLLER

The **IRSC** controller from Zennio allows controlling electronic appliances with built-in infrared receivers (such as air-conditioning systems, ducted climate units, audio/video systems…) by emulating their IR remote controls.

Three alternate application programs are provided:

- **IRSC Plus**, for controlling Split units.
- **IRSC Open**, for controlling A/V devices.
- **IRSC Zone**, for controlling ducted Cool/Heat units with support for climate zoning.

1.2 IRSC ZONE

The **IRSC Zone** application allows controlling **air cooling/heating ducted machines**, and particularly up to 8 rooms (or zones) where the air output is regulated by gates or **motorised grilles**. Grilles are the final elements of the air ducts that distribute the air flow from the central unit to every zone.

IRSC Zone is therefore in charge of two complementary functions:

- Sending the necessary orders (ON/OFF, temperature, fan, etc) to the **central air-conditioning machine** through infrared commands.
- Sending the KNX bus open/close orders for the external actuators that control the **air grilles** of the different climate zones.

In addition, IRSC Zone offers **compatibility** with most air conditioning manufacturers (please refer to the Correspondence Table, available at http://www.zennio.com).

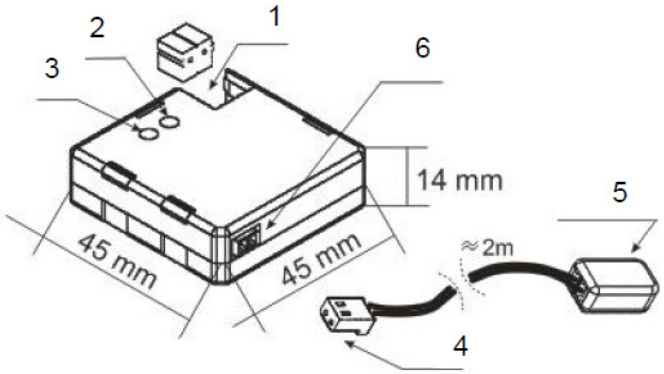
Figure 1. The IRSC Controller

1.3 INSTALLATION

The IRSC controller connects to the KNX bus via the corresponding bus terminals.

Once the controller is provided with power from the KNX bus, both the physical address and the associated application program may be downloaded.

The element diagram of IRSC is shown in Figure 2.



1.- KNX Connector.
2.- Programming LED.
3.- Programming Button.
4.- Aerial Connector.
5.- IR Emitter.
6.- Socket for the Aerial

Figure 2. IRSC Element diagram

These elements are described next.

- **Programming Button (3)**: a short press on this button sets the device into the programming mode, making the associated LED (2) light in red. If this button is held while plugging the device into the KNX bus, IRSC enters the Safe Mode.
- **IR Emitter (5)**: infrared flashing diode to send commands to the air conditioning system. It must be placed in front of the IR receiver of the A/C unit (see Figure 3).

- **Socket for the Aerial Connector (6)**: slot for the insertion of the aerial connector, through which the IR commands are outputted from IRSC.

Figure 3 shows how to locate the IR Emitter (5) in front of the climate system.

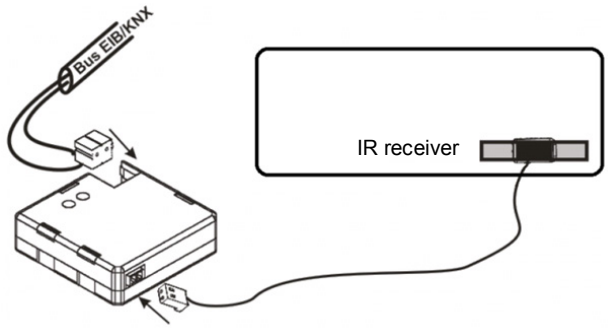


Figure 3. IRSC - A/C unit interface

Once IRSC is connected and properly parameterised, it will be possible to operate the A/C unit from within the KNX installation (for instance, from the InZennio Z38i or InZennio Z41 touch panels), thus offering an easier and more intuitive control.

Note: *one IRSC is required per ducted air-conditioning unit.*

To obtain detailed information about the technical features of IRSC, as well as on security and on the installation procedures, please refer to the device **Datasheet**, bundled with the original packaging of the device and also available at http://www.zennio.com.

2 CONFIGURATION

2.1 GENERAL CONCEPTS

The IRSC Zone application program permits controlling air-conditioning systems from different manufacturers as if they were being controlled through their own infrared remote controls.

A correspondence table is available at the Zennio homepage (http://www.zennio.com) with the codes (from 0 to 255) corresponding to the different remote controls that can be emulated. This number is the first parameter to be set in ETS, so that the orders sent by IRSC become particularised for the actual A/C unit to be controlled.

The IRSC Zone application also allows selecting the number of zones that will be controlled by the same central A/C machine, which can be 1 – 8.

Moreover, the following functions of the A/C system can be controlled by IRSC:

- **Switching ON/OFF** each of the enabled zones.
- **Temperature Setpoint** of each enabled zone.
- **Working Mode**: the desired working mode (Automatic, Heat, Cool, Fan, Dry) may be chosen through independent binary objects (one per mode) or through a sole object (only one object for the mode selection). Moreover, apart from these conventional controls, it is possible to enable a simplified control, which only permits commuting from Heat to Cold and vice versa.
- **Fan Speed**: step-controlled or through a precise control.
- **Thermostat**: it is possible to enable and configure this functionality for the Heat mode, the Cool mode, or both.

The central machine is controlled by taking into account the number of the zones to be acclimatised, as well as their own setpoints:

- The IRSC Zone application program **calculates the temperature setpoint** that the central machine needs to be sent depending on what the desired temperatures for the different zones are.

- It is optionally possible to make this calculation also depend on an **additional feedback temperature**, provided by a KNX sensor located next to the air flow that returns to the machine, thus making it possible to correct undesired switch-offs or adjustments made by the machine itself when it detects that the ambient temperature of its actual location (which may be subject to punctual heat or cold sources) is similar to the setpoint, although the ambient temperatures of the zones are not.

- Moreover, this calculation will also consider the "**additional temperature**", if parameterised with a value other than zero (see Section 3.5).

Apart from sending temperature setpoints and other orders to the air machine, IRSC is, as already stated, responsible for **controlling the air grilles of the zones**, which implies selecting and applying an algorithm which, depending on the setpoint and reference temperatures of every zone, will continuously determine whether the grille of each zone must stay open or not.

The independent control of these grilles makes it possible, in short, that a sole machine with a unique temperature setpoint serves each of the zones as convenient, no matter if the temperature setpoints of the zones are different.

All the concepts mentioned so far are explained in detail in section 3. For further details and for a complete example, please refer to the Annexes of this manual.

3 ETS PARAMETRIZATION

To begin with the parameterization process of the IRSC controller it is necessary, once the data base of the product (**IRSC Zone** application program) has been imported to ETS, to add the device to the project where desired. After that, one right-click on the device will permit selecting "Edit parameters", in order to start the configuration.

In the following sections a detailed explanation can be found about the different functionalities of IRSC Zone available in ETS.

3.1 DEFAULT CONFIGURATION

This section shows the default configuration the device parameterization starts from for the first time.

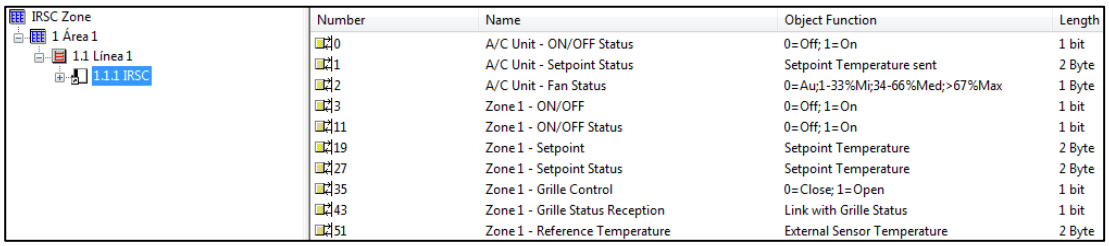

IRSC Zone
1 Área 1
1.1 Línea 1
1.1.1 IRSC
Number
Name
Object Function
Length
0 A/C Unit - ON/OFF Status 0=Off; 1=On 1 bit
1 A/C Unit - Setpoint Status Setpoint Temperature sent 2 Byte
2 A/C Unit - Fan Status 0=Au;1-33%Mi;34-66%Med;>67%Max 1 Byte
3 Zone 1 - ON/OFF 0=Off; 1=On 1 bit
11 Zone 1 - ON/OFF Status 0=Off; 1=On 1 bit
19 Zone 1 - Setpoint Setpoint Temperature 2 Byte
27 Zone 1 - Setpoint Status Setpoint Temperature 2 Byte
35 Zone 1 - Grille Control 0=Close; 1=Open 1 bit
43 Zone 1 - Grille Status Reception Link with Grille Status 1 bit
51 Zone 1 - Reference Temperature External Sensor Temperature 2 Byte

Figure 4. IRSC Zone Default topology

The following communication objects appear: "**A/C Unit - ON/OFF Status**", "**A/C Unit - Setpoint Status**" and "**A/C Unit - Fan Status**", all of which will report basic information about the states of the A/C unit (ON/OFF, setpoint and fan speed).

Seven more objects, of different lengths, are shown, referred to different functionalities that may be controlled for Zone 1 (Zone 1 is the only zone enabled by default). These are ("x" means 1 here):

- **Zone x – ON/OFF**: permits turning ON or OFF each of the enabled zones independently. Being ON implies a normal function of the zone, i.e., the automatic control of its airing grille and the inclusion of its temperature setpoint into the calculation process of the general temperature setpoint sent to the air conditioning machine. On the other hand, when a zone is turned OFF, an order to close the grille is sent to the bus, after which the setpoint of the zone is not

considered anymore (until the zone is turned on again) for the calculation of the central setpoint.

- **Zone x – ON/OFF Status**: indicates the current state (ON/OFF) of the corresponding zone.
- **Zone x – Setpoint**: permits receiving orders from the bus to change the desired temperature setpoint (in ºC) for the corresponding zone.
- **Zone x – Setpoint Status**: indicates the current value (in ºC) of the temperature setpoint of the corresponding zone.
- **Zone x – Grille Control**: sends orders ("0"=Close, "1"=Open) to the bus to control the airing grille of the corresponding zone.
- **Zone x – Grille Status Reception**: permits the arrival from the bus of open/close orders for the airing grille of the corresponding zone, which –when appropriate– makes the device respond with an updated order to the bus through the "**Zone x – Grille control**" object.
- **Zone x – Reference Temperature**: permits the reception from the bus of a reference temperature, for example measured by a sensor installed inside the corresponding zone.

If more zones are enabled (see section 3.2), the same seven objects will be available for the remaining zones, with a different value for "x" in each case.

When entering the parameter edition of IRSC Zone for the first time, the following window will be shown:

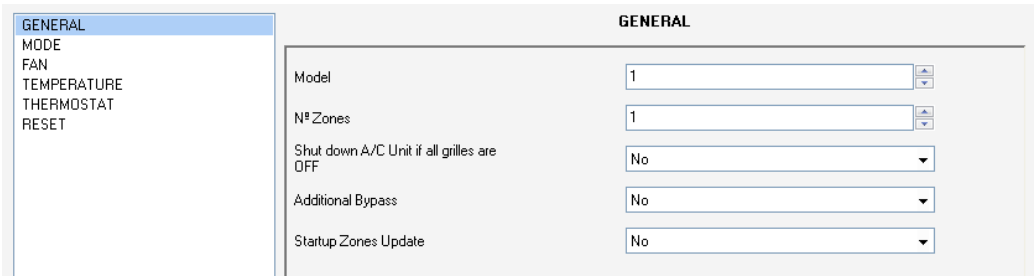


Figure 5. Configuration screen by default

As shown in Figure 5, the configuration screen is divided into the following main tabs:

- **General**: general configuration of the basic functionalities of the air conditioning system to be controlled.
- **Mode**: mode selection type permitted by the A/C machine.
- **Fan**: parameters related to the control of the fan speed of the A/C machine.
- **Temperature**: parameters related to the temperature setpoint sent to the A/C machine.
- **Thermostat:** selection and configuration of the parameters related to the thermostat, both for the Cool and the Heat modes.
- **Reset:** selection of whether to send or not the different states of the A/C machine to the KNX bus after a bus power failure or after an application or parameter download.

All the aforementioned tabs are explained in detail in the next sections.

3.2 GENERAL

As shown in Figure 5, in the General window it is possible to configure the main parameters of the A/C system being controlled. These are:

- **Model**: sets the code number (between 0 and 255) associated to the remote control to be emulated (please refer to the correspondence table at http://www.zennio.com).
- **No. of Zones**: selects how many zones are to be acclimatised (from 1 to 8). Depending on the number established here, seven communication objects will appear associated to each zone (those associated to Zone 1 are enabled by default), making it possible to send and/or receive different orders related to the acclimatization of the zone: On/Off, Setpoint, Grille control and reference temperature (see section 3.1).
- **Shut Down A/C Unit if all Grilles are OFF**: this parameter allows defining the behaviour of the A/C machine when the grilles of all the enabled zones are closed. If this parameter is enabled ("Yes"), when all the grilles are closed (i.e.,

all the "**Zone x - Grille Control**" objects have the value "0") the A/C machine will be switched off. This option may be interesting for systems where a bypass to avoid excessive overpressures is not available.

- **Delay to Turn ON A/C if any Grille is ON**: field to set the time, in seconds, the device will wait before switching on the A/C unit after a grille is opened again ("**Zone x - Grille Control**" = 1). This option may be interesting for systems with thermally-driven grilles.

- **Additional Bypass**: the activation ("Yes") of this parameter allows controlling a bypass or additional grille through which the exceeding air conditioned from the installation could be canalised, thus preventing over-pressure.

  - **Open Bypass if no. of Open Grilles Lower or Equal Than**: defines the maximum permitted number of closed grilles (from 0 to 8) before an order to open the bypass is forced (via the "**Additional Bypass**" object). In other words, the bypass will stay open while the number of open grilles is equal or lower than the number set for this parameter. For instance, if the value "4" is typed here, the bypass will stay open while the number of open grilles is 4, 3, 2, 1 or 0 (in the case of 0, this will be true only if the machine is ON). Note that no matter what the value of this parameter is, the bypass will stay open if the A/C machine is ON and all the grilles are closed.

- **Zone Update on Start-up**: permits activating or deactivating the sending of certain read requests to the bus after a download or a device reset order from ETS. These requests make it possible for IRSC Zone to assimilate the state of the environment (setpoints, temperatures, modes) at the moment of beginning to function. Read orders are therefore sent through the following objects, for every enabled zone:

  - Zone x – ON/OFF
  - Zone x – Setpoint
  - Zone x – Reference Temperature

  Read orders will also be sent through the following control objects, if enabled:

  - A / C Unit – Modes

- A / C Unit – Simplified Mode
- A / C Unit – Fan Precise
- Temperature Restriction

It is **important** that the communication objects being requested are linked (through the same group addresses) to those from any external device aware of the state at any time, and that the Read flag ("R") is enabled for them. Otherwise IRSC Zone may not be able to receive feedback from them.

Consequently, instead of adopting the default values, IRSC-Zone will listen to the responses received from the KNX environment, therefore **making it possible that IRSC-Zone recovers the control over a particular situation** (where, for instance, certain zone setpoints have already been set) no matter if successive downloads or resets from ETS take place, and without the need of acting again over the user interfaces (such as the InZennio Z41 touch panel) that let the user set those values and therefore make IRSC-Zone aware of them. It is recommended, however, to enable sending the statuses to the bus on start-up (see section 3.7), so that the actual status of the grilles matches at any time the one assumed or calculated by the controller, for example, after a download.

Enabling this parameter also brings the following two:

- **Delay [x 1 sec]**: sets a certain delay to be counted since the end of the start-up process of the device, before the corresponding read requests are sent to the bus.
- **Zone Update After Reset**?: if this parameter is enabled, the already mentioned read requests will also take place after power failures or after disconnecting and connecting the device.

Note: *if one or more particular objects do not get a response to their read requests, they will maintain their default values. On the other hand, if IRSC Zone does receive a response to the read request of the "ON/OFF", "Setpoint" and "Reference Temperature" objects before having the response to the read request of the Mode object, the calculation of the general setpoint and the grille control will take place by initially assuming the default mode (Cool). If*

afterwards a response is received to the Mode request and it turns to be other than Cool, this control will be restarted and, typically, the unit will be sent new orders while the grille state also changes, if needed.

3.3 MODE

The Mode window allows configuring features related to the selection of the operating mode of the A/C machine, which is made assuming that the A/C machine supports the selection of up to five working modes:

- **Cool**: intended for zone cooling. When IRSC Zone receives an order to commute to this mode, it sends the corresponding mode switch order to the unit, and begins to control the grilles of every zone according to how the thermostat control for cooling has been parameterised, and to whether the reference temperatures are higher or not than the setpoints (see section 3.6 as well as *Annex II. Grille control* and *Annex III. Practical example*).

  In relation to the calculation of the general setpoint, mode “Cold” implies, on the one hand, switching from one range of accepted temperature setpoints to another range of accepted temperature setpoints (see Section 3.5). And on the other hand, the fact that the general temperature setpoint must be lower or equal than the coolest of the zone temperature setpoints.

- **Heat**: intended for zone heating. When IRSC Zone receives an order to commute to this mode, it sends the corresponding mode switch order to the unit, and begins to control the grilles of every zone according to how the thermostat control for heating has been parameterised, and to whether the reference temperatures are higher or not than the setpoints (see section 3.6 as well as *Annex II. Grille control* and *Annex III. Practical example*).

  In relation to the calculation of the general setpoint, mode “Heat” implies, on the one hand, switching from one range of accepted temperature setpoints to another range of accepted temperature setpoints (see section 3.5). And on the other hand, the fact that the general temperature setpoint must be greater or equal than the hottest of the zone temperature setpoints.

- **Auto**: destined to let the machine decide by itself how to behave at each moment (sending cold air / sending hot air).

- **Fan**: destined to generate a simple air flow, typically at ambient temperature, from the air conditioning machine. When this mode begins, IRSC Zone keeps the air grilles of every enabled zone permanently open

- **Dry**: destined to generate a dry air flow, typically at ambient temperature, from the air conditioner machine, so that the humidity in the air is reduced.

As shown in Figure 6, the Mode window allows configuring the commutation from one mode to another will be performed:

Figure 6. Mode window

- **Individual Control**: when this option is selected, all the described working modes will be selectable through one specific 1-bit communication: this means that 5 objects will be deployed for establishing one of the available modes (Auto, Cool, Fan, Heat and Dry), by sending the value "1" through them, as well as 5 more objects for reflecting the status (active, not active) of every individual mode.

- **1 Byte Control**: when this option is selected, the working modes can be controlled through a unique 1-byte communication object, "A/C Unit - Modes [1 byte]", by sending the value corresponding to the mode to be activated. It is also possible to check at any time the current working mode of the A/C unit, via the "**A/C Unit - Mode Status [1 byte]**" 1-byte object.

- **Simplified Control**: when this option is selected, the "**A/C Unit - Simplified Mode**" 1-bit object will be enabled. It allows establishing the desired mode: Cool mode (writing the value "0" in the object), or Heat mode (writing the value "1"). There is no status object associated to this control object.

The three control types can be enabled jointly, making it possible to control the functioning mode by alternative means at any time. Note that, anyway, changing from

one mode to another has two major consequences: first, the sending of the mode switch order to the machine; and second, switching IRSC Zone (when required) from one thermostat and grille control type to another.

Note: *the algorithm for controlling the zone airing grilles (open/close) is available in* Annex II. Grille control*. In addition, section 3.5 and* Annex III. Practical example *explain the calculation process of the general setpoint, based on the zone temperature setpoints and the current working mode.*

3.4 FAN

The Fan window allows selecting how the fan speed control of the A/C machine will be performed

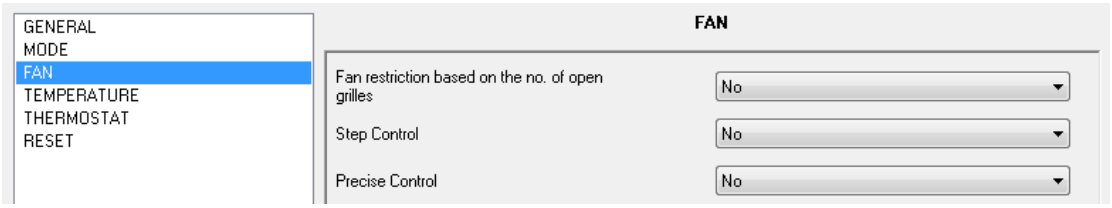


Figure 7. Fan window

- **Fan Restriction Based on the No. of Open Grilles**: if this parameter is enabled ("Yes"), it will be possible to limit the air flow from the A/C unit according to the number of open grilles. The levels that may be set are: “Only Medium”, “Only Minimum” or “Medium and Minimum”. Depending on the selected option, one of the following boxes will be shown (or both, if “Medium and Minimum” is selected).

  - **Force Minimum Fan Under**: sets the minimum number of grilles that must be open before it is permitted to leave the minimum fan speed (object "**A/C Unit - Fan Status**" will reflect the current fan speed; see Table 1).

  - **Force Medium Fan Under**: sets the minimum number of grilles that must be open before it is permitted to commute from the medium fan speed to the maximum fan speed (object "**A/C Unit - Fan Status**" will reflect the current fan level; see Table 1).

Initial speed percentage	Interpolated speed percentage	Level
0%	0%	Auto
1-33%	33%	Minimum
34-66%	66%	Medium
67-100%	100%	Maximum

Table 1. Fan speed percentages

- **Step Control**: selecting this option ("Yes") brings the "**A/C Unit - Fan Step**" 1-bit object, which allows increasing (sending the value "1") or decreasing (value "0") the fan speed by one level (for example, under the minimum level of speed, if the value "1" is sent via this fan step object, the speed will become medium).

- **Precise Control**: selecting this option ("Yes") brings the "**A/C Unit - Fan Precise**" 1-byte object, which allows establishing the value, in percentage, of the desired fan speed level, according to the values shown in Table 1.

Step control and Precise control can be jointly enabled, so that the fan speed can be controlled in one manner or other at any time, as desired.

3.5 TEMPERATURE

From this window it is possible to configure several parameters related to the temperature setpoint sent to the A/C Unit.

Note that the parameters shown below do not apply in modes “Auto”, “Fan” or “Dry”.

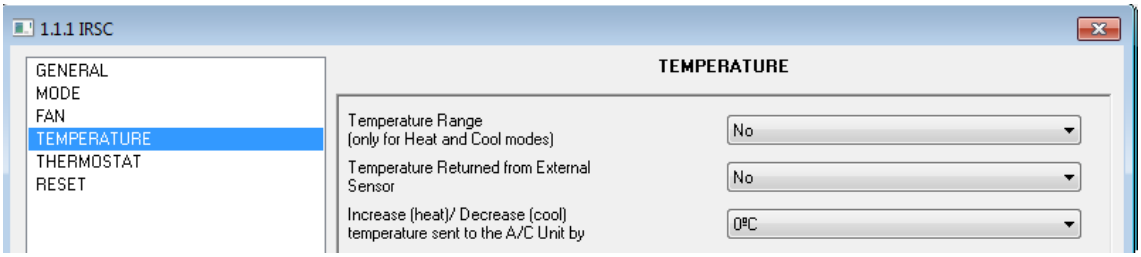
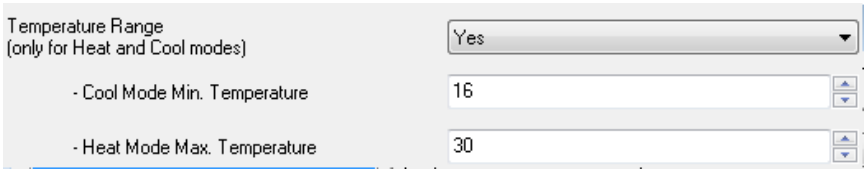


Figure 8. Temperature window

- **Temperature Range (only for Heat and Cool modes)**: it is possible to define limits for the temperature setpoint sent to the machine of each mode:



- **Cool Mode Min. Temperature**: establishes the minimum general temperature setpoint, in ºC, allowed for the Cool mode. This value must be in the range 16-30ºC.

- **Heat Mode Max. Temperature**: establishes the maximum temperature setpoint, in ºC, allowed for the Heat mode. This value must be in the range 16-30ºC.

Once this option has been enabled, the "**Temperature Restriction**" 1-bit object becomes available, with value "1" by default. Temperatures will be subject to the above limits only while the value of this object is "1". The value "0", on the other hand, means that the parameterised restriction should be escaped.

If a setpoint over the maximum limit or under the minimum level is calculated while the temperature restriction is active, the setpoint value effectively sent to the A/C unit will become truncated to the corresponding limit.

Note: *the temperature setpoint sent to the machine may exceed the parameterised restrictions (even if the "Temperature Restriction" object has the value "1") in the case of having parameterised a calibration (parameter "Increase (heat) / Decrease (cool) Temperature Sent to the A/C Unit by", explained below) or if the "Temperature Returned from External Sensor" parameter, explained next, is enabled.*

Note 2: *some particular details apply in case of enabling the temperature restriction together with the Calibration or the External return temperature functions. For further details, please refer to* Annex III. Practical example.

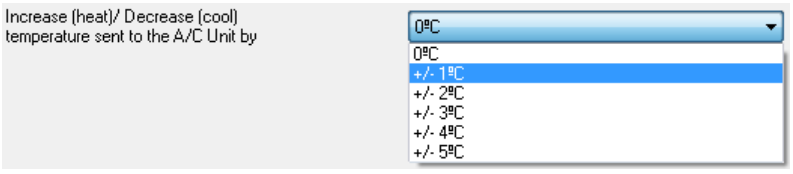
- **Temperature Returned from External Sensor**: this parameter can be optionally enabled, if a return air duct exists, with the aim of adapting the general setpoint calculation process in certain cases when a heat or cool source is affecting the temperature of the returned air that arrives back to the

machine, while it does not affect the ambient temperature of the enabled zones.

Once this parameter is enabled, a 2-byte object, "**External Temperature Returned**", shows up so it can be linked to a KNX sensor (refer to *Annex I. Installation Scheme* to better identify the proper location for the sensor in the installation). During the calculation of the general setpoint, IRSC Zone will consider this return temperature as an additional reference, so it will compare it to the setpoints of the different zones that are ON at that moment. If the return temperature is higher (mode "Heat") or lower (mode "Cool") than the desired temperatures for the zones, IRSC Zone will require the machine to make an "extra effort", and will send (through the "**A/C Unit – Setpoint Status**" object) a general setpoint equal to the return temperature increased (mode "Heat") or decreased (mode "Cool") by 1ºC. It is recommended to read the application example in *Annex III. Practical example* for a better comprehension.

Note: *it is necessary that the external KNX sensor periodically sends the measured temperature (the period should not be more than one hour). In case IRSC Zone does not receive any temperature through the Returned Temperature object within 60 minutes, it will stop taking into account this external temperature for the calculation process*.

- **Increase (heat) / Decrease (cool) temperature sent to the A/C unit by**: sets an additional temperature value (calibration), in ºC, which will be taken into account while calculating the temperature setpoint that will be sent to the A/C unit. Depending on the current working mode of the machine (Heat or Cool), this value will be added or subtracted, respectively, to the resulting temperature (after applying the restrictions and the comparison to the returned temperature, if they apply).



To better understand all these concepts, an application example has been included in *Annex III. Practical example* of this manual.

3.6 THERMOSTAT

From the Thermostat window it is possible to enable and configure the thermostat functionality for cooling, heating or both.

In the case of not enabling a certain thermostatic control (the one for cooling, the one for heating or both), the status of the grilles will be determined by the status of their zone (zone ON, grille open; zone OFF, grille closed).

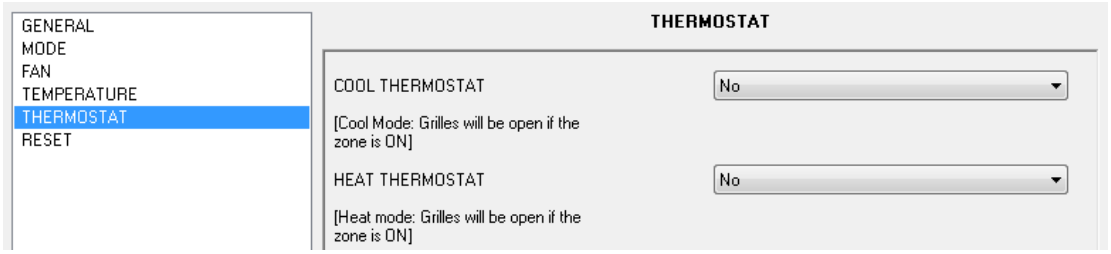


Figure 9. Thermostat window

Both, the Cool thermostat and the Heat thermostat, admit the following configurable parameters:

- **Control Type**: permits selecting one of these options: 2-point control or PI control (PWM).

  - **2-Point Control**

    - Lower/Upper Hysteresis: the desired value, in tenths of a degree, for the lower and upper hysteresis, respectively.

  - **PI Control (PWM)**

    - Cycle Time: value, in minutes, for the sending period of the PWM control variable during the grille control process.

    - Proportional Band: parameter required for calculating the proportional integral function, expressed in Kelvin.

    - Integral Time: parameter required for calculating the proportional integral function, expressed in minutes.

Annex II. Grille control includes a brief introduction to these two thermostatic control methods, and to what they involve in relation to grille control. In addition, to obtain detailed information about all these parameters related to the thermostatic control, please refer to the specific document "**Zennio Home Thermostat**", available at http://www.zennio.com.

3.7 RESET

From this window, it is possible to configure whether to send or not to the KNX bus and/or to the A/C unit the statuses of the different options that have been enabled by parameter, after recovering from a bus power failure and/or after a device reset or a download from ETS.

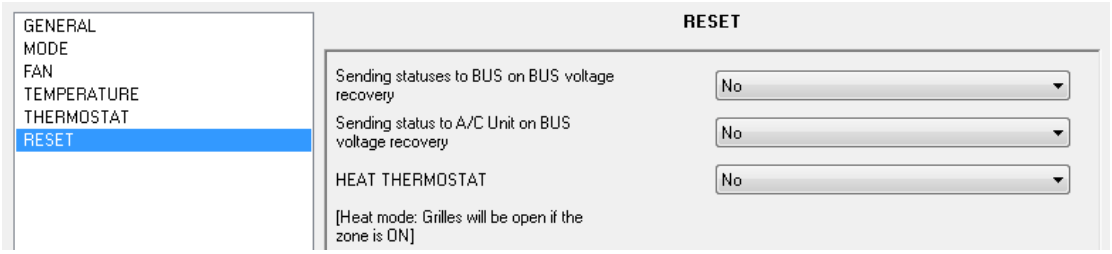
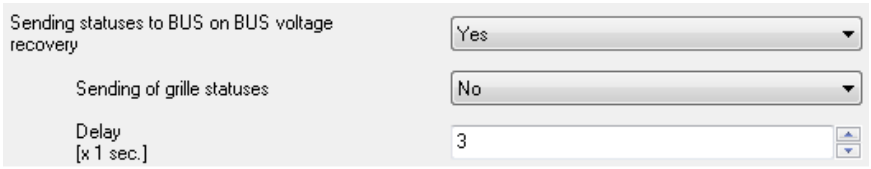


Figure 10. Reset window

- **Sending Statuses to Bus on Bus Voltage Recovery**: it allows choosing whether to send the status objects of the A/C unit to the KNX bus or not after a bus power failure, a device reset order from ETS or a download.



  - **Sending of Grille Statuses**: sets if grille status objects ("**Zone x - Grille Status Reception**") should be sent to the bus in addition to the machine status objects after a bus power failure, a device reset from ETS or a download.

  - **Delay**: time, in seconds, that IRSC will wait before proceeding with this sending.

- **Sending Status to A/C Unit on Bus Voltage Recovery**: allows choosing whether to send or not the current status values to the A/C unit (i.e., through infrared commands) after a bus power failure, a device reset from ETS or a download.

  - **Delay**: time, in seconds, that IRSC will wait before proceeding with this sending.

Related to device reboots, there is also the option to make IRSC Zone send read requests to the bus in order to get updated values of the objects that determine the initial state it should assume when it becomes functional. Such option (**Zone update on start-up**) has been described in section 3.2.

Note: *when the initial sending is enabled from the Reset window having already enabled the "Zone Update on Start-up" parameter from General, special attention must be paid while setting the **delays** of both parameters. The purpose of enabling the latter is that IRSC Zone requests state information from the KNX system, so it would not make sense that, prior to this, IRSC Zone had already sent control orders, thus overwriting the original state.*

ANNEX I. INSTALLATION DIAGRAM

Figure 11 shows a typical diagram of an installation with three different climate zones, controlled by an IRSC Zone.

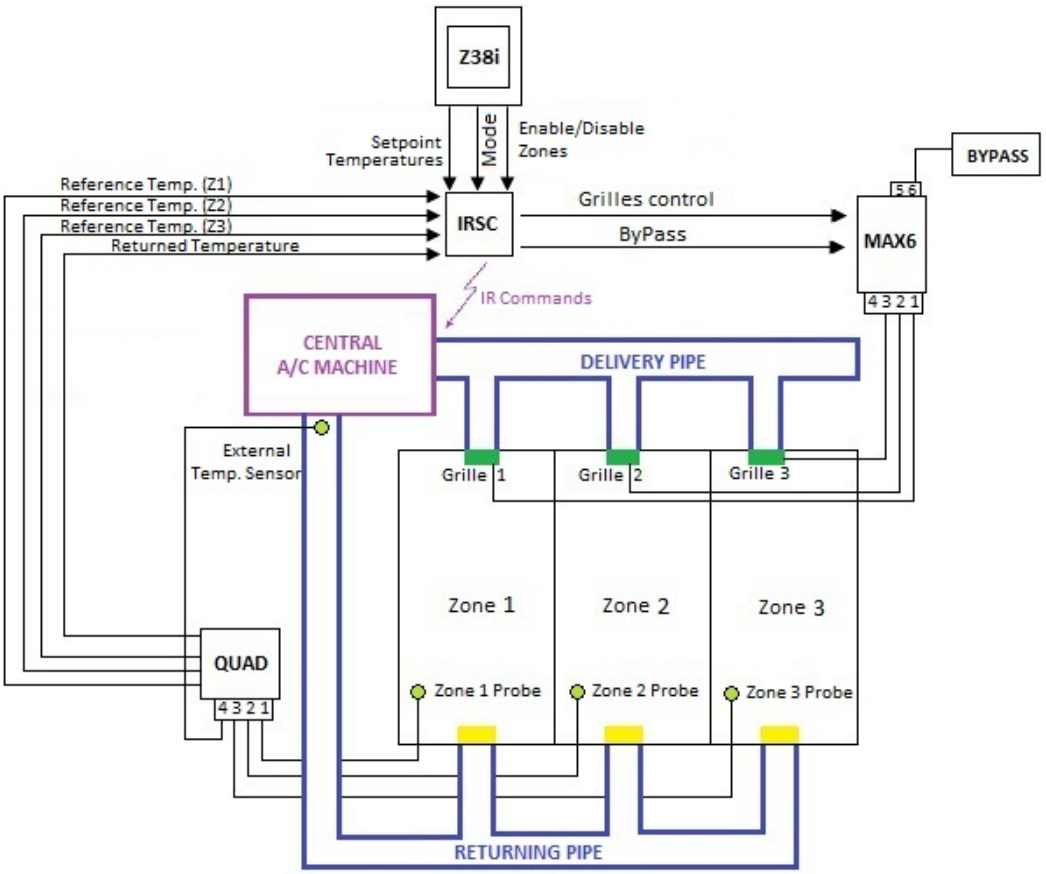


Figure 11. Scheme Installation example

The IRSC interface (programmed with the IRSC Zone application program) carries out the thermostatic control of the installation by receiving data from an external touch panel (InZennio Z38i or InZennio Z41) and from a sensor (QUAD), which measures the temperatures of the different zones enabled in the installation. With this input data, and according to the configuration parameterised in ETS, IRSC Zone will send orders, via IR commands, to the central A/C machine to acclimatise the installation zone by zone, as desired.

To get an optimal acclimatization, it is recommended to install the external sensor in the inner side of the returning pipe, as closest as possible to the central A/C machine.

ANNEX II. GRILLE CONTROL

SWITCHING THE ZONES ON / OFF

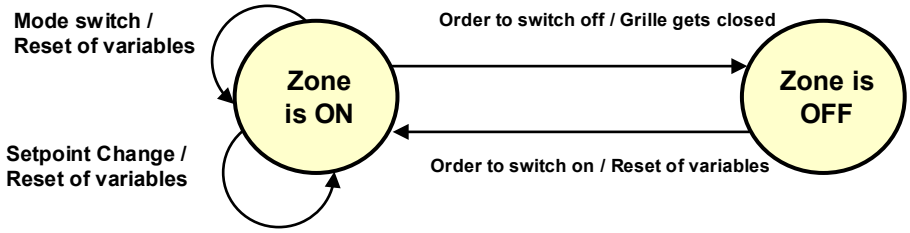


Figure 12. "Zone ON" / "Zone OFF" state diagram

While the zone is in the ON state, the thermostatic control and the grille control stay active, so the temperature setpoint of the zone is taken into account by the device in order to calculate the general temperature setpoint for the air conditioning unit, after which it will periodically send, when required, the pertinent Open or Close orders to the zone grille depending on the particular setpoint and reference temperatures of that zone[1].

During this process, every time the user changes the zone setpoint, as well as whenever the working mode is changed, all the variables are reset and the calculation is resumed according to the new mode and the new setpoint. If, on the contrary, a zone switch-off order arrives, IRSC Zone will close the corresponding grille and will stop considering the setpoint of that zone for the calculation of the A/C unit general setpoint.

While the zone is OFF, every mode change order and every setpoint change order will be ignored. Only once the zone is switched on again, IRSC Zone will resume the corresponding calculation and will send the order to open back the grille, if such order is considered to be required.

[1] As explained in section 3.6, if no thermostatic control has been enabled, the grilles will stay open as long as the zone is ON, and closed as long as it is OFF.

THERMOSTATIC CONTROL FOR COOLING

In case the zone is in the ON state and the selected working mode is either Auto, Cool, Fan or Dry, IRSC Zone will base the calculation process on the parameters set by the integrator for the Cool mode (on the contrary, the parameters of the Heat mode are only taken into account under the Heat mode). Among other things, such parameterisation determines the algorithm to be used for the temperature control: either **2-Point Hysteresis** or **PI (PWM Modulation)**.

The first one (2-Point Hysteresis) determines whether to open ("**Zone x – Grille control**" = 1) or to close ("**Zone x – Grille control**" = 0) the grille, according to the diagram shown in Figure 13.

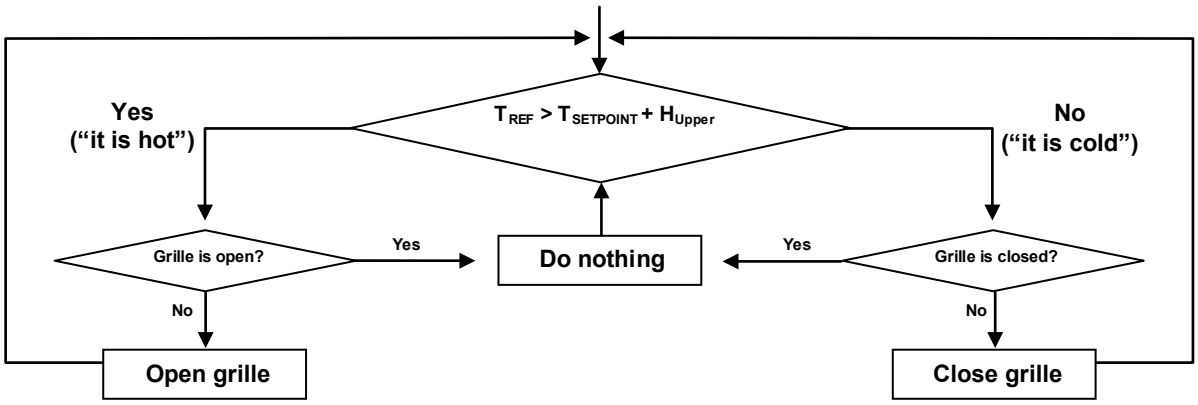


Figure 13. Grille behaviour during the "2 point hysteresis" thermostatic control for cooling

Regarding the second method (PI Control), it consists in the continuous execution of the "PI control" mathematic algorithm, which permanently determines, depending on how the setpoint and the reference temperature of the zone differ, the proper opening level for the grille. Considering that not every grille permits partial opening, this percentage is then interpreted as the ratio between the time the grille will stay open and the time it will stay closed, given the parameterised cycle time.

THERMOSTATIC CONTROL FOR HEATING

In an exactly analogous manner, the thermostatic control for heating permits selecting between a 2-point with hysteresis control and a PI control with pulse width modulation. In this case, the flow diagram for the first one is as shown in Figure 14.

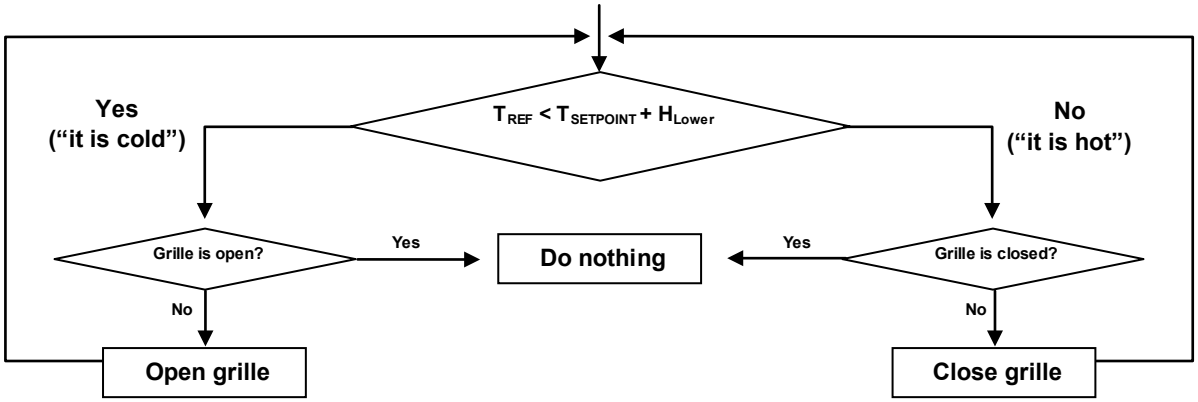
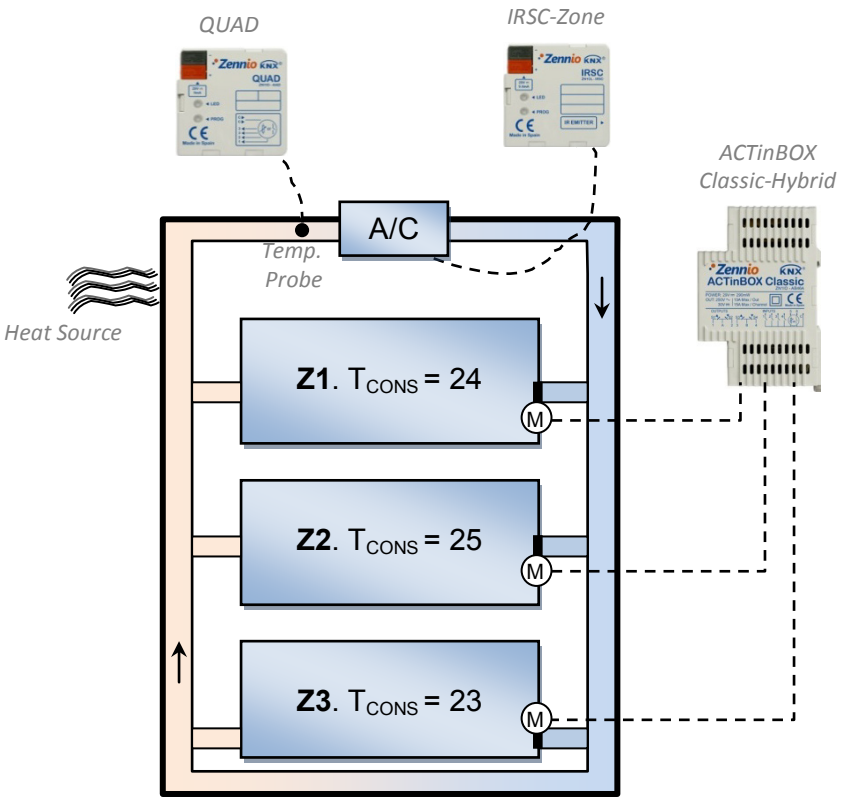


Figure 14. Grille behaviour during the 2 point with hysteresis" thermostatic control for heating

ANNEX III. PRACTICAL EXAMPLE

The following example is provided with the aim of making it easier to understand the concepts explained in this manual and the parameterization process of the device.

Suppose a KNX installation as the one in the figure, where three zones (Z1, Z2 and Z3) are being acclimatised in the "Heat" mode by an IRSC Zone and an A/C unit. Also assume that zone Z3 has been switched off and that a maximum temperature of 24ºC has been parameterised for the Heat mode, and that the "**Temperature Restriction**" object has been previously assigned the value "1".



Under these circumstances, if the "External Temperature Returned" parameter is found to be disabled, IRSC Zone analyses the temperature setpoints of zones Z1 and Z2 (since Z3 has been switched off):

- The general setpoint will be, at first, the **maximum** among them: 25ºC.
- Because of the temperature **restriction**, this will be truncated to 24ºC.
- If, furthermore, an additional **calibration** of +1ºC has been parameterised for

"Increase/decrease Temperature Sent to the A/C unit", an extra degree will be added, resulting a final setpoint of 25ºC (note that the calibration has a higher priority than the parameterised temperature range).

However, since there is a heat source that overheats the air returning to the machine, the built-in thermostatic control of the A/C unit understands that the ambient temperature is high enough (even higher than the setpoint), which makes the unit stop generating heat, even if the ambient temperatures in Z1 and Z2 is different from that measured by the internal sensor of the A/C unit. To prevent this situation, it is convenient to enable the "Temperature Returned from External Sensor" parameter in ETS, as the temperature measured in the return air duct is approximately equal to that registered by the internal sensor of the A/C unit. For instance:

- **External** temperature returned = 26.5ºC

IRSC Zone will then look for the maximum among the temperature setpoints of zones Z1 and Z2, and, afterwards, for the maximum between this (25ºC, which is truncated to 24ºC) and the external temperature (26.5ºC), resulting to be 26.5ºC. By default, this value is then internally increased by one degree (27.5ºC) when the external temperature function is active. And then, another degree is added again because of the parameterised calibration (28.5ºC). Finally, the value 28.5ºC is sent to the unit through the "**A/C Unit – Setpoint Status**" object. This way, the air machine will keep generating enough hot air even if its own sensor is measuring an ambient temperature of about 26.5ºC. To sum up:

- Setpoint comparison → 26.5ºC.
- Restriction → 24ºC.
- External return temperature → 26.5ºC.
- Extra degree (because of the external return temperature) → 27.5ºC
- Calibration → 28.5ºC. (value sent to the machine).

From that moment, IRSC Zone will send the appropriate orders to the grilles in zones Z1 and Z2 (according to the parameterised algorithm for the thermostatic control for heating) so that the heat generated by the unit is conveniently directed to the zones, depending on their setpoint and reference temperatures.

ANNEX IV. COMMUNICATION OBJECTS

- **"Functional range**" shows the values that, with independence of any other values permitted by the bus according to the object size, may be of any use or have a particular meaning because of the specifications or restrictions from both the KNX standard or the application program itself.
- "**1st boot**" shows the cases where an object is assigned a certain value by the application program after a device download or a full reset. In case the value of such assignment can be parameterised, √ is shown in column "**P**". Objects showing a hyphen (-) are not assigned a particular value and therefore can be assumed to be initialised with the value "0" or with the corresponding updated value in case they depend on an external element (sensors, etc.). Moreover, if the object is sent (or is there an option to send it) to the bus (write or read requests) after a download or a device reset from ETS, the marks **(W)** or **(R)** will be shown, respectively for transmissions or read requests.
- "**Reboot**" shows the cases where an object is assigned a certain value by the application program after a bus power failure. In case the value of such assignment can be parameterised, √ is shown in column "**P**". Objects showing a hyphen (-) are not assigned a particular value and therefore can be assumed to maintain their previous value after the failure or with the corresponding updated value in case they depend on external elements (sensors, etc.). Moreover, if the object is sent (or is there an option to send it) to the bus (write or read requests) after a bus failure, the marks **(W)** or **(R)** will be shown, respectively for transmissions or read requests.

Number	Size	I/O	Flags	Data Type (DPT)	Functional Range	1st boot	P	Reboot	P	Name	Function
0	1 Bit	O	C T R - -	DPT_Switch	0/1	- (W)		- (W)		A/C Unit - ON/OFF Status	0=Off; 1=On
1	2 Bytes	O	C T R - -	DPT_Value_Temp	-273.00 – 670760.00	25.00 (W)		- (W)		A/C Unit - Setpoint Status	Temperature setpoint sent
2	1 Byte	O	C T R - -	DPT_Scaling	0% - 100%	25% (W)		- (W)		A/C Unit - Fan Status	0%Au;1-33%Mi;34-66%Med;>67%Max
3 - 10	1 Bit	I	C T - W U	DPT_Switch	0/1	- (R)		- (R)		Zone x - ON/OFF	0=Off; 1=On
11 - 18	1 Bit	O	C T R - -	DPT_Switch	0/1	-		-		Zone x - ON/OFF Status	0=Off; 1=On
19 – 26	2 Bytes	I	C T - W U	DPT_Value_Temp	-273.00 – 670760.00	25.00 (R)		- (R)		Zone x - Setpoint	Temperature setpoint
27 - 34	2 Bytes	O	C T R - -	DPT_Value_Temp	-273.00 – 670760.00	25.00		-		Zone x - Setpoint Status	Temperature setpoint
35 - 42	1 Bit	O	C T R - -	DPT_Switch	0/1	- (W)		- (W)		Zone x - Grille Control	0=Close; 1=Open
43 - 50	1 Bit	I	C - - W U	DPT_Switch	0/1	-		-		Zone 1 - Grille Status Reception	Link with Grille Status
51 - 58	2 Bytes	I	C T - W U	DPT_Value_Temp	-273.00 – 670760.00	- (R)		- (R)		Zone x - Reference Temperature	External Sensor Temperature
59	1 Bit	I	C T - W -	DPT_Switch	0/1	-		-		Additional bypass	0=Close; 1=Open

Number	Size	I/O	Flags	Data Type (DPT)	Functional Range	1st boot	P	Reboot	P	Name	Function
60	1 Byte	I	C T - W U	[20.105] DPT_HVACContrMode	0=Auto; 1=Heat; 3=Cool; 9=Fan; 14=Dry	3 (R)		- (R)		A/C Unit - Modes [1byte]	0=Aut;1=Ht;3=Cool;9=Fan;14=Dry
61	1 Byte	O	C T R - -	[20.105] DPT_HVACContrMode	0=Auto; 1=Heat; 3=Cool; 9=Fan; 14=Dry	3 (W)		- (W)		A/C Unit - Modes Status [1byte]	Actual Mode:0=Auto,1=Heat,etc.
62	1 Bit	I	C T - W U	[1.17] DPT_Trigger	0/1	-		-		A/C Unit - Heat Mode	1=Set Heat mode; 0=Nothing
63	1 Bit	O	C T R - -	[1.17] DPT_Trigger	0/1	-		-		A/C Unit - Heat Mode Status	1=Heat mode is Set; 0=Not Set
64	1 Bit	I	C T - W U	[1.17] DPT_Trigger	0/1	1		-		A/C Unit - Cool Mode	1=Set Cool mode; 0=Nothing
65	1 Bit	O	C T R - -	[1.17] DPT_Trigger	0/1	-		-		A/C Unit - Cool Mode Status	1=Cool mode is Set; 0=Not Set
66	1 Bit	I	C T - W U	[1.17] DPT_Trigger	0/1	-		-		A/C Unit - Dry Mode	1=Set Dry mode; 0=Nothing
67	1 Bit	O	C T R - -	[1.17] DPT_Trigger	0/1	-		-		A/C Unit - Dry Mode Status	1=Dry mode is Set; 0=Not Set
68	1 Bit	I	C T - W U	[1.17] DPT_Trigger	0/1	-		-		A/C Unit - Fan Mode	1=Set Fan mode; 0=Nothing
69	1 Bit	O	C T R - -	[1.17] DPT_Trigger	0/1	-		-		A/C Unit - Fan Mode Status	1=Fan mode is Set; 0=Not Set
70	1 Bit	I	C T - W U	[1.17] DPT_Trigger	0/1	-		-		A/C Unit - Auto Mode	1=Set Auto mode; 0=Nothing
71	1 Bit	O	C T R - -	[1.17] DPT_Trigger	0/1	-		-		A/C Unit - Auto Mode Status	1=Auto mode is Set; 0=Not Set
72	1 Bit	I	C T - W U	[1.100] DPT_Heat_Cool	0/1	3 (R)		- (R)		A/C Unit - Simplified Mode	0=Cool; 1=Heat
73	1 Byte	I	C T - W U	DPT_Scaling	0% - 100%	25% (R)		- (R)		A/C Unit - Fan Precise	0%Au;1-33%Mi;34-66%Me;>67%Max
74	1 Bit	I	C - - W U	DPT_Switch	0/1	-		-		A/C Unit - Fan Step	0=Lower; 1=Higher
75	1 Bit	I	C T - W U	DPT_Enable	0/1	1		-		Temperature Restriction	1=T.Restricted; 0=No restric.
76	2 Bytes	I/O	C T R W U	DPT_Value_Temp	-273.00 – 670760.00	25.00		-		External Temperature Returned	External Sensor Temperature

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